

**IN THE UNITED STATES DISTRICT COURT
FOR THE NORTHERN DISTRICT OF OKLAHOMA**

STATE OF OKLAHOMA, <i>et al.</i>)	
)	
Plaintiffs,)	
)	
v.)	Case No. 4:05-cv-00329-GKF-PJC
)	
TYSON FOODS, INC., <i>et al.</i>)	
)	
Defendants.)	
)	

**DEFENDANTS' RESPONSE TO PLAINTIFFS' MOTION TO EXCLUDE
DEFENDANTS' EXPERT REPORT REGARDING THE FEASIBILITY OF
PLAINTIFFS' HYPOTHETICAL ALUM REMEDIATION STRATEGY (Dkt. No. 2242)**

EXHIBIT 1

**UNITED STATES DISTRICT COURT
FOR THE NORTHERN DISTRICT OF OKLAHOMA**

STATE OF OKLAHOMA, ex. rel. W.A. DREW
EDMONDSON, in his capacity as ATTORNEY
GENERAL OF THE STATE OF OKLAHOMA
and OKLAHOMA SECRETARY OF THE
ENVIRONMENT, J.D. Strong, in his
capacity as the TRUSTEE FOR NATURAL
RESOURCE FOR THE STATE OF
OKLAHOMA

Plaintiffs,

v.

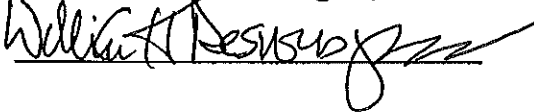
TYSON FOODS, INC., TYSON
POULTRY, INC., TYSON CHICKEN, INC.,
COBB-VANTRESS, INC., AVIAGEN, INC.,
CAL-MAINE FOODS, INC., CAL-MAINE
FARMS, INC., CARGILL, INC., CARGILL
TURKEY PRODUCTION, LLC, GEORGE'S
INC., GEORGE'S FARMS, INC., PETERSON
FARMS, INC., SIMMONS FOODS INC., and
WILLOW BROOK FOODS, INC.,

Defendants.

Case No. 05-CV-329-GKF-PJC

EXPERT REPORT OF

William H. Desvousges, Ph.D.



Gordon C. Rausser, Ph.D.



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4. CRITIQUE OF CONTINGENT VALUATION SURVEY

This section describes the numerous biases in the Stratus CV survey questionnaire and key survey findings. As shown above, only after finding the unsatisfactory results (from their perspective) using the methods based on unbiased estimates of actual behaviors, did the plaintiffs' experts turn to the CV methodology. This methodology has been shown to be subject to substantial hypothetical biases, especially for passive users or nonusers, stemming from flaws in the survey questionnaire, as well as the survey administration. The Stratus CV survey describes a hypothetical referendum for a restoration project that would restore water clarity and ecosystem services to levels purported to have existed in the 1960s. Two important questions that we consider about this hypothetical referendum are whether the description is consistent with the appropriate conceptual economic underpinnings and whether respondents processed the description in the way that the analysts intended. Of course, that intention should be such that people's responses are elicited in a way that minimizes the potential for bias. The Stratus questionnaire and survey embodies numerous critical flaws in the description of the hypothetical commodity that render the survey responses invalid and the results unreliable for use in a damage assessment. Specifically, our analyses demonstrate that:

- The CV survey questionnaire contains biased and misleading information.
- CV survey respondents are valuing a commodity other than a faster recovery of the algae conditions for the Illinois River and Tenkiller Lake.
- The CV results contain substantial hypothetical bias.
- The CV results are an artifact of the hypothetical bid structure.
- The CV survey results suffer from nonresponse bias.

Each of these flaws, among others, is discussed below.

4.1 The CV survey questionnaire contains biased, misleading, and factually incorrect information.

Maintaining neutrality in a questionnaire is of critical importance in any survey, but especially in surveys used in litigation. The survey literature contains many

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examples of the effects of non-neutral wording in biasing results (Rea and Parker 2005; Rossi, Wright, and Anderson 1983). The NOAA Panel specifically addresses neutrality by emphasizing the importance of a conservative design (Arrow, et al. 1993). While no set protocol exists for determining what constitutes neutral and conservative language, researchers should, at the very least, present balanced and unbiased information when describing the environmental issues.

The Stratus CV survey purports to provide respondents with an impartial description of the background regarding water quality conditions in the Illinois River System and Tenkiller Lake. In fact, the Stratus CV questionnaire is anything but balanced and unbiased. Examples of the bias are littered throughout the questionnaire. Among the most egregious examples of bias in the Stratus survey are the representations of the safety and efficacy of the proposed alum restoration project. Specifically, the survey questionnaire states that:

Alum is used to keep pickles crisp, and you can buy alum powder in the grocery store for many uses, including cooking and making "play dough" for children.

If alum is put on land, it attaches to phosphorous in the soil to form harmless particles. When these particles wash into rivers and lakes, the particles sink to the bottom and do not help algae grow.

For more than 35 years, alum has been used successfully and safely to remove phosphorous and reduce algae in many states, such as Colorado, Texas, Missouri, South Dakota, Florida, Wisconsin, and Washington.....Experiences in those states have convinced scientists that alum does not harm fish or other things living in water, and that alum treatments here in Oklahoma could safely return the river and Lake to what they were like in around 1960.

Thus, the alum picture painted in the survey (reinforced by the grocery store photograph that shows alum powder in a small spice container next to other spices used by home cooks) is that the alum restoration program would be a safe and effective way to reduce algae in the Illinois River System and Tenkiller Lake.

The safety of alum for fish and other biota is a subject of considerable debate in the scientific community. Specifically, Connolly, Sullivan, and Coale (2009) cite

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numerous references as to the potential risks to fish and other biota from the use of alum in a restoration project. Chief among these problems for fish and other biota are:

- Possible morphological deformities in benthic communities
- Diminished survival of some spring spawning fish and bottom-dwelling amphibians
- Possible chronic effects on fish.

Clearly, the Stratus questionnaire provides no mention of such potential risks to fish or other biota (p.18).

Connolly, Sullivan, and Coale (2009) further note the risks to forage grasses from the application of alum to pasture lands. They indicate that the science of alum restoration for forage grasses is anything but well-developed and that such a large-scale program as proposed in the questionnaire would raise significant technical issues, especially ones related to substantial changes in the acidity of the soils that would require application of other minerals on a large scale to offset the alum impacts. Moreover, Connolly, Sullivan, Coale (2009) indicate that determining the rate of application for alum and the other minerals would have to be done on a field-by-field basis because of the diversity of acidity levels in the soil. Finally, the Stratus questionnaire fails to mention that the alum application would take place on private lands, which would raise significant implementation problems for the hypothetical program. Alum restoration on land would pose substantial risks to forage grasses, which are critical to the economic well-being of the farmers who raise cattle in the Illinois River watershed. None of these risks, or the potential economic trade-offs that may be associated with an alum restoration program, is described in the survey questionnaire.

Connolly, Sullivan, and Coale (2009) indicate that alum restoration projects in other locations have been the subject of considerable controversy among various interest groups, especially nearby residents. They cite case studies in which proposed restoration projects were either delayed for several years, or modified because of public concerns about the safety to fish and shellfish. The Stratus CV survey designers

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presented none of this information about the reaction in other communities to alum restoration projects in the survey questionnaire for the Illinois River System and Tenkiller Lake.

Similarly, the questionnaire fails to reflect the unknown efficacy of the proposed alum treatment. Instead, the implementation of the alum restoration program is described in almost trifling simplicity:

Alum could be spread on land from trucks.

Alum could be spread on the lake from boats.

Alum could be sprayed in river water flowing into Oklahoma from Arkansas.

This restoration program is largely a figment of the survey designers' imagination, not the depiction of a realistic restoration option. Perhaps, the most telling refutation of the alum restoration program comes from the plaintiffs' own restoration consultant, Mr. King. Specifically, in his report, Mr. King states (King 2008, p. 19):

However, in a reservoir, such as Lake Tenkiller, high dosages and repeated applications may be needed to be potentially effective in sequestering sediment P. With higher dosages, there is the potential for localized depression of pH with an associated potential increase in aluminum toxicity to aquatic life.

Alum treatment of Lake Tenkiller could potentially reduce the internal loading of P from lake sediments. Using alum typically increases the water clarity. Alum can be toxic to aquatic life at low pH (Cooke et al., 2005). Alum applications are generally effective in lakes from 5 to 15 years (Welch and Cooke, 1999). However, the duration of alum treatment effectiveness in a reservoir such as Lake Tenkiller will not be as long as a lake and will be further reduced proportional to the additional P inputs from the Illinois River, Caney Creek and the Baron Fork. Therefore, the applicability of P inactivation with alum cannot be adequately evaluated until the final remedial measures for the watershed and riverine response regions have been identified in sufficient detail to determine future P and nutrient loadings to Lake Tenkiller.

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When asked about alum restoration in his deposition, he indicated that he had rejected the option because it was not technically feasible. Specifically, Mr. King states (King 2009, pp. 287-288):

Q. On Page 19, one of these potential treatments you discussed is P inactivation with alum, aluminum sulfate; correct?

A. Yes, sir.

Q. This specific potential remedy or remedial step is one that you are not recommending to be implemented at this time; is that correct?

A. I categorized it as requires additional investigation and assessment.

Q. And does that mean that you cannot recommend it at this time based upon the current data in hand?

A. Yes.

Q. To your knowledge, has anyone done a technical evaluation of the feasibility of treating Tenkiller Reservoir with alum?

A. No, no, not that I can think of.

In addition, the Stratus survey contained "scientific" information about the effects of algae on fish in the Illinois River and Lake Tenkiller. This scientific information is presented in such a way as to convey that there is no scientific debate about the accuracy of the information.¹⁸ The key statements include the following:

- Fewer small mouth bass, other fish and small plants in both the IR and Tenkiller Lake
- Large areas of Tenkiller Lake small mouth bass and other types of fish people catch grow slower and there are fewer of them
- Large areas of the bottom of Tenkiller Lake, there are lot fewer insects and small animals than are in the lakes with less algae
- Large mouth bass have increased in numbers and growing more quickly.

¹⁸ Of course, the questionnaire designers note in the survey that scientists agree that the effects of algae were the result of human activities (p. A-13.) Such a statement is so broad as to be meaningless. Nevertheless, it conveys the impression that scientists agree with all the other information that is presented in the survey, which is inaccurate.

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However, Connolly (2009) offers a very different picture as to the impacts of phosphorous on fish populations in the Illinois River and Tenkiller Lake. For example, he concludes:

- The fish community within the Illinois River Watershed is not highly degraded due to water quality impacts. Lower diversity is more of a function in stream-size than reduced water quality.
- Lower diversity is more affected by poor stream habitat than water quality.
- The sample protocols may underestimate the diversity of fish in the Watershed.
- One would expect the bass fishery in Tenkiller Lake to be dominated by largemouth bass, followed by spotted bass, with small mouth bass a minor component due to the habitat requirements of the latter species.

In his deposition, Dr. Cooke, one of the plaintiffs' biological consultants notes that the construction of a dam had a significant impact on small mouth bass in the Illinois River. Specifically, Dr. Cooke states (Cooke 2008, pp. 557-558):

Q. Now, you say in your report that smallmouth bass were abundant in the Illinois River – excuse me, David -- prior to the formation of the lake?

A. Yes.

Q. And when the reservoir was formed, would you and the dam was closed, the lake began to fill, would you agree with me that that created a very different habitat, fish habitat than the flowing Illinois River watershed?

A. I would agree with that.

The CV survey fails to mention any potential impacts from the construction of the dam on the small mouth bass in the Illinois River and Tenkiller Lake, nor does it mention anything about differences in habitat requirements of the various bass species.

The failure to acknowledge any uncertainty among scientists about the potential injuries or the safety and efficacy of alum in the survey questionnaire is a serious flaw. By not reflecting the scientific uncertainty associated with the injury and the restoration program in the survey questionnaire, the survey adds another dimension for biasing the

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survey results to generate a higher damage estimate. The existing literature on uncertainty clearly demonstrates that including such information would have substantially altered the responses. Specifically, it has long been known from the psychological literature that people have a very difficult time answering questions where uncertainty is present. In particular, the literature shows that people's preferences are often poorly formed, are very sensitive to the way questions are framed, and that people are unable to process probabilistic information (Tversky and Kahneman 1981; Slovic, Fischhoff, and Lichtenstein 1982). One research finding that is particularly pertinent to the Stratus CV questionnaire is the so called "certainty effect" (Weinstein and Quinn 1983; Tversky and Kahneman 1981). People respond to questions quite differently when one of the options presented involves a certain outcome. Thus, the Stratus questionnaire presents respondents with a biased, inadequate basis for evaluating the hypothetical restoration program, rendering the results invalid.

Another facet of bias in the CV questionnaire involves the discussion of the poultry industry as the primary source of the algae growth. Specifically, the questionnaire tells respondents that "60 percent of the phosphorous in the IR and TenKiller Lake is from chickens and turkeys." This statement, the accuracy of which is attributed to Dr. Engel's various reports, is of critical importance to the survey designers. Without it, they have no way to associate the phosphorous loads to the Illinois River and Tenkiller Lake with the application of poultry litter.¹⁹ As Connolly, Sullivan, and Coale (2009) state, Dr. Engel's methodology that produces the 60 percent estimate is without scientific foundation. In addition, Dr. Bierman (2009) concludes that Engel's approach is an inappropriate tool for predicting watershed nonpoint source phosphorous loads. Dr. Bierman further concludes that Engel's approach is inconsistent with accepted practices in the scientific community and that it contains numerous and substantial errors. Survey respondents are provided none of this

¹⁹ The survey questionnaire fails to explicitly tell people what will happen to the other forty percent of future phosphorous loads to the Illinois River. Survey respondents likely derived the impression that the combination of alum treatments and the ban on poultry applications would remove both the past and future phosphorous loads from all sources. Of course, if respondents believed such an outcome would occur, their votes would be based on a perception that exceeds the scope of the injury alleged by the plaintiffs in this case.

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information about the questions concerning the scientific validity of Dr. Engel's 60 percent estimate.

Moreover, the questionnaire contains a specific and detailed focus on poultry litter as the cause of the algae. The questionnaire emphasizes the role of the poultry industry by enumerating that 140 million chickens and turkeys are raised each year within the watershed and that these birds produce more than 300,000 tons of litter annually. Other than mentioning, in passing, that the 40 percent of phosphorus attributable to other sources includes sewage treatment and store-bought fertilizer applications and the cattle industry, there is no comparable specificity for these other sources. That is, the questionnaire is silent on the number of individual septic fields within the watershed, the number of households served by sewage treatment facilities within the watershed, and the number of acres of lawns and golf courses to which store-bought fertilizer is applied (among other potential sources of phosphorus). The lack of specificity about the other sources of phosphorus results in an unbalanced and biased questionnaire.

The restoration recovery periods are a critical component of the hypothetical scenarios in the Stratus survey questionnaire. The survey describes the natural recovery for the river and the lake once the ban on poultry litter application was imposed. However, Connolly, Sullivan, and Coale (2009) conclude:

As a result, the statements by Stratus in their Survey that the river and lake would recover to 1960's conditions in about 60 and 50 years, respectively, once poultry litter application was stopped, can not be supported. The models developed by the Plaintiffs can not provide an accurate measurement of this "time to recovery" as they are currently developed and applied. (p.13)

Moreover, Connolly, Sullivan, and Coale (2009) further conclude that there is no scientific basis for the survey's contention that the alum restoration program would speed the return of water quality to its purported historical levels. Specifically, they state:

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However, no scientific basis is given in Chapman et al. (2009) for this 40-year acceleration. The one citation given in the Chapman et al. (2009) report for alum treatment in the watershed (Cooke et al. 2005) actually states that alum treatment of reservoirs is uncommon and somewhat discourages direct application of alum in flowing rivers (see Section 3 of this report for further discussion). Nowhere in Cooke et al. (2005) is information provided that would allow one to quantify the acceleration of recovery using alum (p.13).

In terms of balance, omitting relevant counter-arguments from the text can further bias the respondent. Schuman and Presser (1981) find “that the effects of adding counter-arguments are too pervasive and too large to allow the question forms...to be treated as interchangeable....” In other words, adding counter arguments provides such great changes in response outcomes that questions which provide counter arguments cannot be treated as identical to questions which do not provide counter arguments. The counter argument gives the respondent who has not previously considered an issue a plausible reason for choosing the other side of the issue. Schuman and Presser state: “The counter argument thus provides a genuine degree of cognitive persuasion, and is not merely a matter of social pressure.” Specific counterarguments for the restoration program might be that the program has not been fully evaluated by scientists and the potential economic tradeoffs in the form of higher costs to farmers who grow hay as well as cattle ranchers.

Respondents’ open-ended comments indicate that this questionnaire was not sufficiently balanced in terms of counter-arguments. Near the end of the survey, the questionnaire asks respondents whether they felt pushed to vote in a certain direction. Despite the almost hour long in-person interview dosing respondents with information about water quality impacts from the poultry industry, almost 9 percent of the respondents to the base questionnaire admitted that they felt pushed to vote for the alum treatments.²⁰ When asked why they felt this way, they responded:

- “Because it totally disregarded other things in the land and just spoke of alum and phosphorus”

²⁰ This percent likely understates the percentage of respondents who felt pushed because of their unwillingness to express opinions that the interviewers might have viewed as being critical of the survey. This is another indication of the tendency that respondents have to want to please survey interviewers discussed above.

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- “Because it does not discuss the socio-economic ramifications as in the poultry farmers, the communities supported by jobs in the poultry farms, monies lost by businesses like corn seed, doesn’t discuss the higher cost of food such as poultry”
- “Excess information about the treatment”
- “It seems one-sided. The State wants to do it, so it’s pushing for the alum treatments.”
- “It seemed to only offer evidence to positive effect, but it didn’t seem to offer any side effects to the contrary.”
- “It did not provide enough contradictory information regarding the alum treatments.”
- “Just showed one side.”
- “It seemed to only offer evidence to positive effect but didn’t seem to offer any side effects to the contrary.”
- “Gave a more positive picture of the alum treatments than not.”
- “I think I heard only one side of the story.”
- “This was a state infomercial.”
- “The statements did seem slanted towards the alum treatments. If I had not heard, I probably would have voted against them.”
- “Most of the information was positive for the alum treatments. I would like to hear about other states that have used and any other side effects from it.”
- “Because the opinions of the opposite parties involved were not included.”
- “I didn’t want to vote for something that would hurt farmers and thought it emphasized poultry litter too much, not 60%. I thought that the sewage and chemical fertilizer might affect the river more.”
- “The pictures are taken to specially convince me about the algae. The picture cards e, f, and g are taken to make me vote for them.”
- “That’s why they are spending all this money to send you all here. So we will vote for a tax increase.”

Clearly, based on the responses above as well as the other arguments described earlier, the Stratus questionnaire is seriously deficient in presenting counter arguments.

The photos used to depict the increase in algae are also relevant to the discussion of neutrality and conservative design (Mathews, Freeman, and Desvousges

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2007; Arrow, et al. 1993; Mitchell and Carson 1989). Recall the respondent comment above that the photos were “specially taken to convince me about the algae.” Because “a picture is worth a thousand words,” photos are efficient survey tools. That efficiency is accompanied by the creation of an indelible image in the minds of the respondents. Although the Stratus team claims to use photos that show “relatively mild” algae growth, the differences are striking. They are so striking, in fact, that it is easy to forget that those conditions, where they exist in the river, are present only during a few months of the year and confined to limited areas. The interviewers only verbally mentioned these seasonal and spatial differences, making them easier to forget than the images presented in the photos. Moreover, the questionnaire fails to provide any details on how limited the areas might be that are represented in the photographs. Card N, which provides some reasons why the respondent might choose to vote against the alum treatments, is also silent on both the limited seasonal and spatial algae impacts.²¹ A more neutral approach, to provide balance against the photos’ lasting impressions, would have included both the seasonal and spatial limits on the algae in the photos and would have reminded respondents of these limits just prior to voting as a reason to potentially vote against the program.

Another critically important but biased facet of the Stratus questionnaire is the statement that asks respondents to assume that the Court had decided to impose a ban on the application of poultry litter in the Illinois River watershed. Such a statement is likely to indicate that the Court had already sanctioned the ban, when in fact the Court decided not to impose the temporary injunction sought by the plaintiffs in this case. The likely effect of such a statement is to mislead people to think that the Court agreed that the application of litter was a serious problem. Otherwise, it would not have been stopped. Such a misleading statement imports significant bias making it more likely that respondents would vote for the hypothetical restoration program.

Notifying the respondents of the sponsor of the survey, such as the use of the introductory letter from the State of Oklahoma, may cause them to respond as they believe the sponsor would like them to answer. Presser, Blair, and Triplett (1992) find a

²¹ Connolly, Sullivan and Coale (2009) express criticisms of the photos from a scientific water quality perspective as well.

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significant change in response distribution when the sponsor is named. They hypothesize that this result reflects the conjunction of two factors. First, respondents perceive that the sponsor had taken a clear position on the subject in question. In addition, the issue was one on which it was likely the respondent had not already formed an opinion. This CV survey clearly exhibits both of the qualifications that Presser, Blair, and Triplett (1992) hypothesize to be important: (1) the State clearly has an opinion on this subject or they would not be sponsoring the survey, and (2) because the scenario is hypothetical, respondents could not have previously formed an opinion.

Results from the earlier telephone survey conducted by Stratus likely influenced the information content in the CV questionnaire. As described above in Section 2.2, Stratus conducted a telephone survey of Oklahoma residents in 2006 to assess the knowledge and use of the Illinois River System and Tenkiller Lake, to determine perceptions about water quality, and to identify any impacts from media coverage of the environmental issues within the watershed (Stratus 2007). Table 4.1 below provides the progression of the questions asked about respondents' impressions of the Illinois River System and Tenkiller Lake.

Table 4.1: Respondents' Impressions and Knowledge about Tenkiller Lake and the Illinois River from 2006 Telephone Survey

Survey Question	Percent of Respondents mentioning poultry litter
"What impression do you have about the Illinois River? Is there anything especially good or bad about the Illinois River?"	6%
"What impression do you have about Tenkiller Lake? Is there anything especially good or bad about the Lake?"	2%
"Have you heard of any issues or concerns relating to the Illinois River or Tenkiller Lake or are you unaware of any issues or concerns there?"	16%
"What about water quality in the Illinois River and Tenkiller Lake? Are you aware of any water quality problems there or have you not heard of any water quality problems?"	26%

As those results show, increasing the amount of prompting and information used in the question can alter the responses to the survey. Respondents tend to agree

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and provide the interviewer with the information they are looking for, which may not necessarily reflect their true impressions or opinions. As more information is given to prompt the respondent to provide information about water quality problems, more respondents comply and recognize the issue in their responses. After the telephone survey results were shared with the Stratus team, one member commented: “If estimated damages are to be significant, people will have to be educated about the injuries. There is currently not a lot of knowledge of the injuries” (Morey 2006).

Rather than first ask the 2008 CV respondents the extent of their knowledge and impressions in a manner similar to the 2006 telephone survey, the 2008 CV questionnaire *first* described the environmental issue as viewed by the plaintiffs and *then* asked respondents whether they had heard about these issues. Almost one-third of the 2008 respondents indicated that they had heard about the algae. This higher response may be due in part to respondents not wanting to appear uninformed about issues in their state. It is possible that the increasing media coverage of the Illinois River watershed and the Attorney General's lawsuit has raised awareness. Nevertheless, Stratus chose to not ask the 2008 respondents their impressions prior to “educating” them. Not doing so is inconsistent with a conservative design required by the NOAA Blue Ribbon Panel. Not doing so makes it impossible to disentangle potential nonuse values that respondents may have held prior to taking the survey and the nonuse values that were created during the “education” process that occurred in the CV survey. Thus, the Stratus questionnaire has artificially inflated, and in some instances created, the concerns about water quality in the Illinois River System and Tenkiller Lake by dosing the respondents with new (and, in some cases, flawed and erroneous) information before eliciting their opinions.

4.2 Many survey respondents valued a different commodity than was intended by the survey designers, rendering the results invalid.

A critical requirement for a CV survey is to provide information to respondents about the commodity so that they understand and accept it and can give a meaningful answer to the valuation question. The Stratus CV survey results reveal that respondents did not understand or accept the information in the CV scenario and thus did not value the commodity they were being asked to value—the return of water clarity